

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with **Attorney Robert W. Strozier Reg. No. 34,024 on July 30, 2010** along with authorization to charge any necessary fees to applicant's deposit account.
3. The application has been amended as follows:

A) Cancel claims 1 through 47 of the March 29th 2010 listing of claims:

B) Insert claims 48 through 54 of the March 29, 2010 listing of claims:

Claim 48 --- The apparatus of **claim 58**, wherein each member further comprises:
a substrate dielectric layer upon which the superconducting layer was formed,
where the dielectric layer of the straight members comprise
a rigid dielectric material and
the dielectric layer of the curvilinear members comprise
a flexible dielectric material.---

Claim 49 --- The apparatus of **claim 58**, wherein the superconducting layer of the curvilinear members comprise
a plurality of substantially flat superconducting segments.---

Claim 50 --- The apparatus of **claim 49**, wherein the overlapping regions of the superconducting layer of the curvilinear member comprise

one of the substantially flat superconducting segments.---

Claim 51 --- The apparatus of **claim 58**, wherein the overlapping region dielectric layers comprise

separate dielectric layers distinct from the substrate dielectric layers.---

Claim 52 --- The apparatus of **claim 51**, wherein the substrate and the overlapping region dielectric layers are composed of the same or different dielectric material.---

Claim 53 --- The apparatus of **claim 58**, wherein the overlapping region dielectric layers comprise

portions of the substrate dielectric layers of the members.---

Claim 54 --- The apparatus of **claim 58**, wherein each coil apparatus includes:
a metal layer formed on an exposed portion of a dielectric layer or an external dielectric layer formed on an exposed portion of a superconducting layer with a metal layer formed on the outer surface of the external dielectric layer, where the metal layer forms a coupling or decoupling capacitive element with a corresponding portion of the superconducting layer.---

C) Replace claims 55 and 56 of the March 29th 2010 listing of claims with the following Examiner amended claims 55 and 56:

Claim 55 ---The apparatus of **claim 54**, each coil apparatus further includes:

a wire bonded to the metal layer, where the wire links a plurality of the apparatuses together to form an array or to connect the apparatus to a pre-amplifier.---

Claim 56 ---The apparatus of **claim 58**, further comprising:

a plurality of separated spaced apart apertures, each configured to receive a small nonhuman animal **allowing the MRI apparatus to simultaneously receive and image a plurality of animals with MRI.** ---

D) **Cancel claim 57 of the March 29th 2010 listing of claims:**

E) **Replace claims 58 through 61 of the March 29th 2010 listing of claims with the following Examiner amended claims 58 through 61:**

Claim 58 ---An MRI apparatus capable of imaging small nonhuman animals comprising:

a vacuum housing including

at least one aperture, where each aperture is configured to receive a small nonhuman animal,

a coolant assembly including

a coolant inlet,

a coolant outlet and

a cold plate, where a coolant is configured to cool the cold plate,
at least one resonator,

each resonator comprising:

two closed saddle-shaped coils in thermal contact with the cold plate,
each saddle-shaped coil comprising:

four members, each member including a superconducting layer, where the members are arranged in order to form four overlapping regions, each overlapping region comprises:

a capacitor formed from overlapping portions of the superconducting layers of two of the members and an overlapping region dielectric layer interposed therebetween,

where two of the members are straight and two of the members are curvilinear in order to form the closed saddle-shaped coils, and

where a resonator surrounds each at least one aperture.---

Claim 59 ---An MRI apparatus capable of simultaneously imaging **at least two** small nonhuman animals comprising:

a vacuum housing including

at least two single-sided, non-collinear apertures, each aperture configured to receive a small nonhuman animal allowing the MRI apparatus to simultaneously receive a plurality of small nonhuman animals,

a coolant assembly including

a coolant inlet,

a coolant outlet and

a cold plate, where a coolant is configured to cool the cold plate, at least two resonators comprising:

a plurality of closed saddle-shaped coils in thermal contact with the cold plate and arranged in order to form a cylindrical structure,

where a resonator surrounds each aperture, and

where the MRI apparatus is capable of simultaneously imaging a small nonhuman animal placed in each of the at least two single-sided, non-collinear apertures with MRI.---

Claim 60 ---The apparatus of **claim 59**, wherein the at least two resonators also comprise: two closed saddle-shaped coils.---

Claim 61 ---The apparatus of **claim 60**, wherein each closed saddle-shaped coil comprises:

four members, each member including

a superconducting layer, where the members are arranged in order to form four overlapping regions, where each overlapping region comprises a capacitor formed from overlapping portions of the superconducting layers of two of the members and an overlapping region dielectric layer interposed therebetween,

where two of the members are straight and two of the members are curvilinear in order to form the closed saddle-shaped coils.---

F) Insert claims 62 through 68 of the March 29, 2010 listing of claims:

Claim 62 ---The apparatus of **claim 61**, wherein each member further comprises: a substrate dielectric layer upon which the superconducting layer was formed, where the dielectric layer of the straight members comprise a rigid dielectric material and the dielectric layer of the curvilinear members comprise a flexible dielectric material.---

Claim 63 ---The apparatus of **claim 61**, wherein the superconducting layer of the curvilinear members comprise

a plurality of substantially flat superconducting segments.---

Claim 64 --- The apparatus of **claim 63**, wherein the overlapping regions of the superconducting layer of the curvilinear member comprise one of the substantially flat superconducting segments.---

Claim 65 --- The apparatus of **claim 61**, wherein the overlapping region dielectric layers comprise separate dielectric layers distinct from the substrate dielectric layers.---

Claim 66 --- The apparatus of **claim 65**, wherein the substrate and the overlapping region dielectric layers are composed of the same or different dielectric material.---

Claim 67 --- The apparatus of **claim 61**, wherein the overlapping region dielectric layers comprise portions of the substrate dielectric layers of the members.---

Claim 68 --- The apparatus of **claim 61**, wherein each coil apparatus includes: a metal layer formed on an exposed portion of a dielectric layer or an external dielectric layer formed on an exposed portion of a superconducting layer with a metal layer formed on the outer surface of the external dielectric layer, where the metal layer forms a coupling or decoupling capacitive element with a corresponding portion of the superconducting layer.---

G) Replace claims 69 through 72 of the **March 29th 2010** listing of claims with the following **Examiner amended claims 69 through 72**:

Claim 69 --- The apparatus of **claim 68**, each coil apparatus further includes: a wire bonded to the metal layer, where the wire links a plurality of the apparatuses together in order to form an array or in order to connect the apparatus to a pre-amplifier.---

Claim 70 --- An MRI apparatus capable of simultaneously imaging at least two small nonhuman animals comprising:

 a vacuum housing including a plurality of separated spaced apart apertures, each aperture configured to receive an animal allowing the apparatus to simultaneously receive a plurality of small nonhuman animals,

 a coolant assembly including a coolant inlet, a coolant outlet and a cold plate, where a coolant is configured to cool the cold plate,

 at least two resonators comprising:

 a plurality of closed saddle-shaped coils in thermal contact with the cold plate and arranged in order to form a cylindrical structure,

 where a resonator surrounds each aperture, and where the MRI apparatus is capable of simultaneously imaging a small nonhuman animal placed in each of the plurality of separated spaced apart apertures with MRI.---

Claim 71 --- The apparatus of **claim 70**, wherein the at least two resonators also comprise:

 two closed saddle-shaped coils.---

Claim 72 --- apparatus of **claim 70**, wherein each closed saddle-shaped coil comprises:

four members, each member including a superconducting layer, where the members are arranged in order to form four overlapping regions, where each overlapping region comprises a capacitor formed from overlapping portions of the superconducting layers of two of the members and an overlapping region dielectric layer interposed therebetween, where two of the members are straight and two of the members are curvilinear in order to form the closed saddle-shaped coils.---

H) **Insert claims 73 through 79 of the March 29, 2010 listing of claims:**

Claim 73 ---The apparatus of **claim 72**, wherein each member further comprises: a substrate dielectric layer upon which the superconducting layer was formed, where the dielectric layer of the straight members comprise a rigid dielectric material and the dielectric layer of the curvilinear members comprise a flexible dielectric material.---

Claim 74 ---The apparatus of **claim 72**, wherein the superconducting layer of the curvilinear members comprise a plurality of substantially flat superconducting segments.---

Claim 75 ---The apparatus of **claim 74**, wherein the overlapping regions of the superconducting layer of the curvilinear member comprise one of the substantially flat superconducting segments.---

Claim 76 ---The apparatus of **claim 72**, wherein the overlapping region dielectric layers comprise

separate dielectric layers distinct from the substrate dielectric layers.---

Claim 77 ---The apparatus of **claim 76**, wherein the substrate and the overlapping region dielectric layers are composed of the same or different dielectric material.---

Claim 78 ---The apparatus of **claim 72**, wherein the overlapping region dielectric layers comprise

portions of the substrate dielectric layers of the members.---

Claim 79 ---The apparatus of **claim 72**, wherein each coil apparatus includes:
a metal layer formed on an exposed portion of a dielectric layer or an external dielectric layer formed on an exposed portion of a superconducting layer with a metal layer formed on the outer surface of the external dielectric layer, where the metal layer forms a coupling or decoupling capacitive element with a corresponding portion of the superconducting layer.---

I) Replace claims 80 of the March 29th 2010 listing of claims with the following
Examiner amended claim 80:

Claim 80 --- The apparatus of **claim 79**, each coil apparatus further includes:

a wire bonded to the metal layer, where the wire links a plurality of the apparatuses together in order to form an array or in order to connect the apparatus to a pre-amplifier.---

J) Replace the title with the following **Examiner amended title:**
---Superconducting Loop, Saddle and Birdcage MRI Coils Capable of Simultaneously Imaging Small Nonhuman Animals---

The following is an examiner's statement of **Reasons for Allowance:**

4. With respect to **Examiner amended independent claims 58, 59 and 70:** These claims are considered to be allowable over the prior art of record because the prior art of record neither discloses nor suggests an MRI apparatus configured for imaging multiple small non-human subjects simultaneously, with an MRI system containing either multiple one-sided or non-collinear apertures or a plurality of separated spaced apart apertures (i.e. separated cavities which do not extend all the way through the MRI system); in combination with a coolant assembly including a coolant inlet, a coolant outlet and a cold plate, where a coolant is configured to cool the cold plate, at least one resonator comprising: a plurality of closed saddle-shaped coils in thermal contact with the cold plate and arranged in order to form a cylindrical structure, where a resonator surrounds each aperture, and where the MRI apparatus is capable of simultaneously imaging a small nonhuman animal placed in each of the plurality of separated spaced apart apertures with MRI.

5. Additionally, the prior art of record does not suggest or show the additional limitations of closed saddle-shaped coil comprising: four members, each member including a superconducting layer, where the members are arranged to form four overlapping regions, where each overlapping region comprises a capacitor formed from overlapping portions of the superconducting layers of two of the members and an overlapping region dielectric layer interposed therebetween, where two of the members are straight and two of the members are curvilinear to form the closed saddle-shaped coils. However, the examiner notes that it is the entire combination of all limitations in each of the respective Examiner amended independent claims, taken together, that constitutes the novelty and nonobviousness of each of applicant's **Examiner amended allowable** independent claims.

6. With respect to **Examiner amended dependent claims 48-56, 60-69 and 71-80**: each of these claims are considered to be allowable over the prior art of record because they each depend from an examiner amended allowable independent claim.
7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Examiner's comment

Drawings

8. The corrected drawings received April 13, 2009 are approved by the examiner.

Prior Art of Record

9. The prior art made of record is considered pertinent to applicant's disclosure.
- A) **Wong et al.**, US patent **6,377,047 B1** issued **April 23, 2002**, filed June 8, 2000.
- B) **Heid et al.**, US patent application publication **2004/0239327** published December 2, 2004, filed March 25, 2004.
- C) The prior art made of record from the November 12, 2008 office action.
- D) **Doty** US patent **6,087,832** issued July 11, 2000.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday, Wednesday, and Friday-Thursday from 7:00am to 2:10 pm., and on Tuesday and Thursday from 7:00am to 5:30pm.
11. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Diego Gutierrez**, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(571) 273-8300**.

Art Unit: 2831

12. Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/TAF/
August 3, 2010

/Brij Shrivastav/
Primary Patent Examiner
Technology Center 2800